

### REMARKS

Applicants appreciate the Examiner's thorough examination of the present application as evidenced by the final Office Action of June 4, 2003 (hereinafter "Final Action").

Applicants, however, respectfully request that the Examiner take one final look at independent Claims 10, 15, 31, and 40. To advance prosecution and to facilitate an early allowance of the present application, Applicants have amended independent Claims 10, 15, 31, and 40 to incorporate recitations from dependent Claims 14, 19, 37, and 46, respectively. Claims 14, 19, 37, and 46 have been canceled without prejudice or disclaimer.

Applicants respectfully submit that the cited references fail to suggest, among other things, forming an impurity layer in upper portions of the trench sidewalls as recited in Claims 10, 15, 31, and 40. Accordingly, Applicants submit that all pending claims are in condition for allowance. Favorable reconsideration of all pending claims is respectfully requested for at least the reasons discussed hereafter. Alternatively, Applicants respectfully request entry of the present amendment as introducing no new issues and narrowing the issues for further consideration.

#### **Independent Claims 10, 15, 31, and 40 are Patentable**

Independent Claims 10, 15, 31, and 40 have been amended to incorporate recitations from dependent Claims 14, 19, 37, and 46, respectively. Dependent Claims 14 and 19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U. S. Patent No. 6,417,047 to Isobe (hereinafter "Isobe") in view of U. S. Patent No. 5,246,877 to Hisamoto *et al.* (hereinafter "Hisamoto"). Dependent Claim 37 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Isobe in view of U. S. Patent No. 6,403,429 to Noble (hereinafter "Noble"). Dependent Claim 46 stands rejected under 35 U.S.C. §102(e) as being anticipated by Isobe.

A determination under §103 that an invention would have been obvious to someone of ordinary skill in the art is a conclusion of law based on fact. *Panduit Corp. v. Dennison Mfg. Co.* 810 F.2d 1593, 1 U.S.P.Q.2d 1593 (Fed. Cir. 1987), *cert. denied*, 107 S.Ct. 2187. After the involved facts are determined, the decision maker must then make the legal determination of whether the claimed invention as a whole would have been obvious to a person having ordinary skill in the art at the time the invention was unknown, and just before it was made.

*Id.* at 1596. The United States Patent and Trademark Office (USPTO) has the initial burden under §103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

To establish a *prima facie* case of obviousness, the prior art reference or references when combined must teach or suggest *all* the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. M.P.E.P. §2143. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. M.P.E.P. §2143.01, citing *In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). As recently emphasized by the Court of Appeals for the Federal Circuit, to support combining references, evidence of a suggestion, teaching, or motivation to combine must be **clear and particular**, and this requirement for clear and particular evidence is not met by broad and conclusory statements about the teachings of references. *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). In an even more recent decision, the Court of Appeals for the Federal Circuit has stated that, to support combining or modifying references, there must be **particular** evidence from the prior art as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed. *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000).

Independent Claim 10 has been amended to include the following recitation: "forming an impurity layer in a second sidewall portion of the trench." Independent Claims 15, 31, and 40 have been amended to include similar recitations. Applicants respectfully submit that the Final Action fails to provide clear and particular evidence from Isobe or other prior art that would motivate a skilled artisan to modify the memory device shown in FIG. 2B of Isobe to include an impurity layer in a sidewall portion of a trench. With reference to FIG. 2B and FIG. 3, Isobe explains that the structure of FIG. 2B in which the gate electrode 38 extends down the upper sidewalls of the trench is an undesirable configuration. Specifically, Isobe states:

If the gate electrode 38 falls into the STI region at edges of an element region, a parasitic transistor appears in the region B surrounded by a circle

mark in the figure. If the parasitic transistor operates, a kink occurs in the subthreshold characteristic, thereby involving increase of the stand-by current.

In particular, if the corner parts of the element region are not rounded, the field-effect concentration effect is increased so that the kink characteristic is emphasized.

To prevent this, it is advantageous to carry out a so-called rounding oxidation step of rounding the corner parts of the edge part A of the element region and of creating birds-beaks in the tunnel oxide film 32, before STI regions are filled with the insulating film 35 during formation of STI, as shown in FIG. 4. By optimizing the thickness of the oxide film in the rounding oxidation step, the extent to which the gate electrodes fall in the STI region can be restricted, for example, as shown in FIG. 5. (Isobe, col. 2, line 62 - col. 3, line 11).

Thus, Applicants respectfully submit that, because Isobe teaches against forming the gate electrode on sidewalls of the trench as such a configuration may increase stand-by current (Isobe, col. 2, lines 64 - 67), Isobe implicitly teaches against forming an impurity layer in a sidewall of the trench as there would be no need for the impurity layer in the trench sidewall without the gate electrode also extending down the trench sidewall. The Final Action cites column 6, lines 32 - 55 and FIG. 8C of Isobe as suggesting the formation of an impurity layer in a sidewall of a trench (Final Action, page 6). Applicants respectfully submit, however, that Isobe merely states that "impurities of a predetermined kind are introduced into predetermined regions so that the transistors to be formed will respectively have predetermined threshold values." (Isobe, col. 6, lines 31 - 34). Isobe contains no disclosure or suggestion that the impurities be introduced into sidewalls of a trench. Moreover, FIG. 8C of Isobe does not show an impurity layer in the trench sidewall nor does it show a gate electrode extending down the trench sidewall(s).

Accordingly, for at least the foregoing reasons, Applicants respectfully submit that independent Claims 10, 15, 31, and 40 are patentable over the cited references and that Claims 11 - 13, 16 - 18, 20, 21, 32 - 36, 38, 39, and 41 - 45 are patentable at least per the patentability of independent Claims 10, 15, 31, and 40.

### CONCLUSION

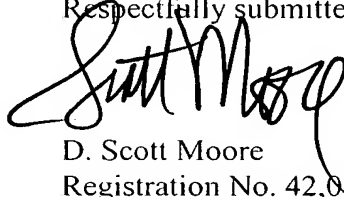
In light of the above amendments and remarks, Applicants respectfully submit that the above-entitled application is now in condition for allowance. Favorable reconsideration of this application, as amended, is respectfully requested. Alternatively, Applicants respectfully

In re: Kang-yoon Lee et al.  
Serial No.: 10/057,745  
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Page 11 of 11

request entry of the present amendment as introducing no new issues and narrowing the issues for further consideration. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

It is not believed that an extension of time and/or additional fee(s)-including fees for net addition of claims-are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper are hereby authorized to be charged to our Deposit Account No. 50-0220.

Respectfully submitted,



D. Scott Moore  
Registration No. 42,011

**USPTO Customer No. 20792**  
Myers Bigel Sibley & Sajovec  
Post Office Box 37428  
Raleigh, North Carolina 27627  
Telephone: 919/854-1400  
Facsimile: 919/854-1401

**CERTIFICATE OF MAILING**

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on August 4, 2003.



Traci A. Brown